

AMENDMENTS TO CLAIMS

Applicants have provided a listing of the claims as amended. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A multistage fluid separation assembly comprising:

a plurality of primary gas cooling devices each of which has a liquefied and/or solidified condensables enriched fluid outlet and a primary condensables depleted fluid outlet; and,

a secondary fluid separation vessel having a tubular section of which a central axis has a substantially vertical or tilted orientation, which vessel is connected to said condensables enriched fluid outlets of said primary gas cooling devices, wherein during normal operation of the vessel the condensables enriched fluid is induced to swirl around the central axis of the tubular section of the vessel such that a tertiary stream-of liquefied and/or solidified condensables is induced by gravity and centrifugal forces to swirl in downward direction alongside the inner surface of the tubular section of the vessel into a liquid collecting tank at or near the bottom of the vessel for collecting a tertiary mixture of liquefied and/or solidified condensables, which tank is provided with one or more heaters for heating the tertiary mixture to reduce the amount of solidified condensables and with one or more outlets for discharging the tertiary mixture from the tank;

wherein the plurality of a liquefied and/or solidified condensables enriched fluid outlets are connected at regular circumferential intervals to the tubular section of the secondary separation vessel which outlets inject in use condensables enriched fluid in an at least partially tangential direction into the interior of the secondary separation vessel.

2. (Previously Presented) The fluid separation assembly of claim 1, wherein the liquid collecting tank comprises an upper liquid outlet for low density liquid components and a lower liquid outlet for high density liquid components.
3. (Previously Presented) The fluid separation assembly of claim 1, wherein the tubular section of the secondary separation vessel is equipped with a tertiary gas outlet conduit having an inlet which is located at or near the central axis of the tubular section.
4. (Previously Presented) The fluid separation assembly of claim 3, wherein the secondary separation vessel has a dome or disk shaped top which is mounted on top of the tubular section and the tertiary gas outlet conduit is arranged substantially co-axial to the central axis of the tubular section and passes through said top.
5. (Previously Presented) The fluid separation assembly of claim 1, wherein the liquefied and/or solidified condensables enriched fluid outlet of at least one primary gas cooling devices injects in use the condensables enriched fluid in an at least partially tangential direction into the tubular section of the secondary separation vessel.
6. (Previously presented) The fluid separation assembly of claim 5, wherein the central axis of the tubular section of the secondary separation vessel has a substantially vertical orientation and said plurality of primary gas cooling devices each of which has a liquefied and/or solidified condensables enriched fluid outlet inject in use condensables enriched fluid in an at least partially tangential and partially downward direction into the interior of the secondary separation vessel.

7. (Previously Presented) The fluid separation assembly of claim 1, wherein the liquid collecting tank is formed by a cup-shaped tubular lower portion of the secondary separation vessel which is substantially co-axial to the central axis and has a larger internal width than the upper portion of the vessel.
8. (Previously Presented) The fluid separation assembly of claim 1, wherein a vortex breaker is arranged in the interior of the secondary separation vessel between the lower end of the tubular section and the liquid collecting tank.
9. (Previously Presented) The fluid separation assembly of claim 1, wherein the assembly is provided with one or more ultrasonic vibration transducers for imposing ultrasonic vibrations on one or more components of the assembly to inhibit deposition of solidified condensables, such as ice, wax and/or hydrates, within the assembly.
10. (Previously Presented) The fluid separation assembly of claim 8, wherein at least the primary gas cooling device each of which has a liquefied and/or solidified condensables enriched fluid outlet and the vortex breaker are equipped with ultrasonic vibration transducers.
11. (Previously Presented) The fluid separation assembly of claim 9, wherein the ultrasonic vibration transducers are designed to vibrate in use one or more components of the assembly at a frequency between 20 and 200 KHz.
12. (Previously Presented) The fluid separation assembly of claim 1, wherein the liquid collecting tank is provided with a grid of heating tubes which are designed to heat the liquid and solid fluid mixture in the tank to a temperature of at least 15 degrees Celsius.

13. (Previously Presented) The fluid separation assembly of claim 1, wherein at least one gas cooling device comprises a primary cyclonic inertia separator comprising an expansion nozzle in which the fluid mixture is cooled to a temperature lower than 0 degrees Celsius by a substantially isentropic expansion and in which one or more swirl imparting vanes induce the fluid to swirl into a diverging outlet section which is equipped with a central primary condensables depleted fluid outlet conduit and an outer secondary condensables enriched fluid outlet conduit.
14. (Previously Presented) The fluid separation assembly of claim 13, wherein each primary cyclonic inertia separator comprises an expansion nozzle designed to accelerate the fluid mixture within the nozzle to a supersonic speed, thereby cooling the temperature of the fluid passing through the nozzle to a temperature lower than -20 degrees Celsius.
15. (Previously Presented) The fluid separation assembly of claim 13 comprising a plurality of primary cyclonic inertia separators of which the expansion nozzles are substantially parallel and equidistant to the central axis of the tubular section of the secondary separation vessel and of which the secondary condensables enriched fluid outlets are connected to secondary fluid injection conduits which intersect the wall of the tubular section of the secondary separation vessel at regular circumferential intervals and in an at least partially tangential direction, and which secondary fluid injection conduits each have a length less than 4 meters.
16. (Previously Presented) The fluid separation assembly of claim 1, wherein the gas cooling devices comprise chokes.

17. (Currently Amended) A method of separating condensable components from a fluid mixture in a multistage fluid separation assembly, the method comprising:

injecting the fluid mixture into a plurality of primary gas cooling devices in which the fluid mixture is expanded and cooled and condensable components are liquefied and/or solidified and in each primary gas cooling device a stream of condensables enriched fluid components is fed into a secondary fluid outlet and a stream of primary condensables depleted fluid is produced; and

injecting the stream of condensables enriched fluid components into a secondary fluid separation vessel having a tubular section of which a central axis has a substantially vertical or tilted orientation and in which the condensables enriched fluid stream is induced to swirl around the central axis of the tubular section of the vessel such that a tertiary mixture of liquefied and/or solidified condensables is induced by gravity and centrifugal forces to swirl in downward direction alongside the inner surface of the tubular section of the vessel into a liquid collecting tank at or near the bottom of the vessel, in which tank the tertiary mixture of liquefied and/or solidified condensables is collected and heated to reduce the amount of solidified condensables and from which tank liquid and/or solidified components are discharged through one or more outlets;

wherein a plurality of secondary fluid injection outlets are connected at regular circumferential intervals to the tubular section of the secondary separation vessel, which outlets inject condensables enriched fluid in an at least partially tangential direction into the interior of the secondary separation vessel.

18. (Previously Presented) The method of claim 17, wherein the fluid mixture is a natural gas stream which is cooled in the gas cooling devices comprising one or more primary cyclonic inertia separators to a temperature below 0 degrees Celsius thereby condensing and/or solidifying aqueous and

hydrocarbon condensates and gas hydrates and the tertiary fluid mixture comprises water, ice, hydrocarbon condensates and gas hydrates and is heated in the tertiary fluid collecting tank to a temperature above 15 degrees Celsius to reduce the amount of gas hydrates, and from which tank low density hydrocarbon condensates are discharged through an upper liquid outlet and high density aqueous components are discharged through a lower liquid outlet.

19. (Previously Presented) The method of claim 17, wherein liquefied and/or solidified components are separated from the gaseous components by centrifugal force in the primary gas cooling device.